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QUIET COMMUNITIES PROGRAM DEMONSTRATION

FINAL REPORT

March 1982

U.S. ENVIRONMENTAL PROTECTION AGENCY
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16. ABSTRACT

A partial assessment of the results of a Federally sponsored program conducted in three cities to demonstrate the best available techniques for developing local noise control. Includes an overall summary and focuses on the correlation between attitudinal and acoustical surveys, between actual noise levels and public perception.

17. KEY WORDS AND DOCUMENT ANALYSIS

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Executive Summary

The assessment measure of the Quiet Community Program experiment is effectiveness. Therefore, the question becomes one of whether or not the experiments were results oriented and effective in demonstrating the best available techniques for local noise control. As stated throughout many literary sources on the subject, the Quiet Community Program experiment has four distinct stages or phases. First is the problem identification stage. Second is the noise control strategy development stage based on the identification of noise problems. Third is the enactment of the local ordinance and maintenance of program operations. Fourth is the enforcement of the ordinance and maintenance of program operations. This program amounted to a field research program under circumstances where EPA/ONAC sought to control as many factors as possible in order to avoid disruptions in each QCP community as it carried out the project.

Our overall assessment of the Quiet Community Program experiment is that it was a good idea whose time had come and then was stopped short of its natural life-span. The notion that cities can address and resolve their own noise problems is just as valid today as it was when the Noise Control Act of 1972 was enacted. However, the priority on noise control is simply not sufficient in all cases to warrant the kinds of expenditure associated with municipal noise programs in cities that are facing constricting budgets and increased demands for services such as police and fire protection. The Quiet Community Program experiment was a venture into the unknown and unpredictable world of local politics in all three cases. If there has ever been or if there ever is any reservation about the overall program, it must be on the basis of the potential obstacles and problems that can be created, whether real or artificial, within local political circles. It is beyond rationality to assume that local political conditions did not have an effect on each of the three QCP project sites. Evidence the fact that the Allentown program is no longer in existence because of political decision-making. Evidence the fact that the political climate was so adverse in Spokane, that the Spokane project did not survive the full year of funding for the first year. Evidence the fact that as of this writing, Kansas City has not enacted a noise ordinance submitted over 7 months ago.

Thus, we have to quality our measurement of the effectiveness of the Quiet Community Program with temperaments consisting of two programs that are no longer in existence and one that may or may not survive. The implication here is that once the Federal support, in terms of dollars and cents, was withdrawn, local support for almost any program including noise control will abate substantially.

A great deal was learned in the Quiet Community Program experiments. However, the primary beneficiaries of the knowledge appear to be those who will receive the benefits of the manual guided attitudinal and acoustical surveys. This is the area where most of the research was accomplished -- in testing and refining a product that, in the final analysis, became unuseable for the final user, Kansas City, in the development of its noise control strategy. Therefore, the research benefits of the program are extremely limited and srictly in the area of computer programming and data analysis techniques. In effect, the Quiet Community Program did nothing to demonstrate new and advanced techniques in noise control -- the project sites merely developed a control strategy from an analysis of their acoustical and attitudinal survey data. If there is another benefit from the program it is in the area of creating the Quiet ethic among the citizens of the respective cities. In fact, this will, in all probability, have the most lasting effect with or without local enforcement of ordinances. Since it is in the realm of human behavior and reaction to excessive noise that change for the quieter will take place.

If there was one tragic flaw in the implementation of the program, it has to be laid at the console box of the computer. Interminable delays, unuseable data, unadaptable programs, and countless other problems besieged the computer based approach to identification of noise problems and formulation of strategy by the computer based NOIZEOP. QCP project staff in all three cases were unable to cope effectively with computer problems and they had to rely entirely on EPA/ONAC expertise and the expertise of an ONAC support contractor. Therefore, it is our opinion that the degree of reliance on the experimental computer programs without adequate manual back-up was most detrimental to the projects. However, once the "bugs" were worked out of a particular computer run, the analyses which proceeded, proceeded well. Thus, the research accomplishments of the Program are limited to the development of the manuals for acoustical and attitudinal measurement. In another section of this report, we discuss the nine research questions which deal primarily with the manual guided surveys.

Our analysis of the three QCP sites revealed another problem which we perceive to be significant. That is, the problem of a program without an active constituency to sustain its momentum. The simple announcement that City X has a noise problem because the survey told it so is not enough. The mere existence of an advisory committee is not enough -- it has to work. One Quiet Day per year is not enough -- people forget too soon. Distant relations with local business and industry are not the key to political support. The active participation of local businesspeople and industrialists is absolutely essential to effective program operation. Confrontational relationships are very likely to erode the effectiveness of any program undertaken at the local level.

As for the best available techniques for noise control, the only experience based on ordinance is in Allentown, Pennsylvania. Since that program no longer exists, no data can be gathered to measure the effectiveness of the controls that were used by the city. Spokane, Washington, never approached an enforceable ordinance before terminating their participation in the program. As of this writing, Kansas City has not enacted an ordinance which leaves the question of best available techniques purely academic and without answer for those three sites.

Moving into the area of "stage specific" assessment of each program, we found that the problem identification stage, despite computer problems which were, for the most part, expected and resolved, was the stage of the program where each city fared well. This is also the area where staff performance was at its highest in each city. Our assessment of the overall problem identification stage of the QCP sites is that it is the most successful part of the project. Each city executed attitudinal and acoustical surveys which formed the basis for their strategy development and ordinance proposal -- even though Spokane never got beyond the first stage, all three cities were highly successful in identifying their noise problems.

With respect to the second stage of developing a noise control strategy, Allentown was more successful than Kansas City simply on the basis of size and the huge data buildup in Kansas City that Allentown did not have to cope with. Kansas City was successful in developing a reasonable noise control strategy which formed the basis for their proposed ordinance. Therefore, both Kansas City and Allentown were successful in adopting workable program strategies detailing how they were going to deal with their respective noise problems.

As previously noted, Kansas City has yet to adopt its noise ordinance. The ordinance has received an official reading in front of the city council and it has met with some resistance from the construction industry. However, we are of the opinion that Kansas City will, in the final analysis, enact their ordinance. That it has proceeded this far is clear evidence of a successful plan to introduce the ordinance and there is every reason to expect final passage. The Allentown ordinance remains on the books and is being enforced by the local authorities. The extent to which it is being enforced is not known because the local QCP office in Allentown closed down. However, the police department has been supportive throughout the entire history of the project so there is no reason to suspect that enforcement has abated or ceased. We cite the fact that in 1981 the police chief of Allentown communicated with the police chief in Kansas City advising him of the benefits of the program and recommending the Kansas City police support of the Kansas City project. Spokane does not have a noise ordinance.

Finally, the enforcement and program maintenance stages of the QCP project become a matter strictly up to local decision and control. The fact that the Allentown QCP office is no longer does not mean that the program is defunct or not working. The enforcement stage continues which indicates that this program is still active. The loss of the QCP office hurt the rest of the activities which were ongoing. However, this can be understood in light of current economic conditions and increased citizen concern for austerity in local budgeting. Since Kansas City has yet to adopt their ordinance, no enforcement assessment is available. Yet the Quiet Community Program office is still open. The staff has been reduced since the Federal support ended. We are led to believe by Kansas City that they will find a method of financing a continuing QCP office within the Kansas City Health Department. These sentiments were expressed to us by City Councilwoman Kay Waldo when we visited with her in August of 1981.

There were, within the context of three separate projects with three entirely different sets of circumstances, moments of brilliance and items well worth honorable mention in this report. It is for the sake of replication by other communities that we list those accomplishments by the QCP sites.

- The use of social/employment programs to augment QCP staff such as programs for Older Americans who participated in all three sites was a brilliant use of individual talent. The fact that one tax dollar did double duty -- by providing meaningful employment for older workers and environmental protection services to the public -- is a viable and commendable activity.

- Public Information Awareness and Education projects carried out by all three cities contributed greatly to raising the level of knowledge of thousands of citizens about noise and what they could do to protect themselves from the hazardous effects of excessive noise. No matter what becomes of any program, the knowledge is permanent and will undoubtedly contribute to a quieter community in all three instances.

- The creation of local expertise about noise and its abatement and control that remains within the institutions and agencies involved with the programs will also remain. In that context, each community will retain the benefits of the experience irrespective of the final outcome of ordinances proposed or enacted.

- The degree to which Kansas City coordinated its QCP project with other local departments and agencies was commendable. The QCP staff made every effort to keep all departments and agencies with direct and tangential interest completely up to date with respect to program operations. This stood the project in good stead among the other agencies in Kansas City and is well worth replication in other cities.

- The fact that the Kansas City project has managed to bring their comprehensive ordinance to a point of second reading before the City Council is impressive in light of the budget considerations the City currently faces and the reduction of Federal financial assistance to the State of Missouri and Kansas City.

- Finally, on an abstract basis, the initiation and implementation of the three site experiments and the existence of the entire QCP experiment has led to an increase in the awareness of State and local officials of the existence of noise as a serious pollutant and has led many of these to initiate their own examination of noise problems. This has been accomplished by virtue of the publicity associated with the experiments, the transfer of expertise from the QCP site to outlying communities and to other governmental levels such as county governments. This increase is bound to have a lasting effect on those communities as well.

In summary, the Quiet Community Program experiment should be viewed as a project that tested the ability of local governmental agencies engaged in noise control which, up to that time, have had little or no real experience and little or no local priority attached to a noise program, to scientifically identify and define their noise problems and to plan a program to cope effectively with them. This was successfully accomplished in all three cases. The fact that two of those programs have closed does not mean that they are not fighting the good fight against noise control as would be perceived necessary by some. It merely affirms the fact that the problem(s) of noise in those communities were brought to light, examined and determined to be or not to be of sufficient priority so as to warrant expenditure of municipal/local tax dollars to resolve. In this respect the program accomplished exactly what it was intended to. To perceive that any great deal of research in any area other than that was, perhaps, unrealistic, which was not the case with the Office of Noise Abatement and Control. The only real tragedy lies in the fact that ONAC was not able to continue the project for one more year in order to measure the effects of the ordinance and its enforcement in Kansas City.

RESEARCH QUESTION #1: ARE THE MANUAL GUIDED ACOUSTICAL AND ATTITUDINAL SURVEYS A VIABLE UNDERTAKING FOR COMMUNITIES?

Briefly, the manual guided acoustical and attitudinal surveys are very definitely viable undertakings for communities. The primary purpose of the surveys is to produce complementary data on the nature and extent of a community's noise problems through standard measurement techniques that are statistically valid. To the extent that the surveys developed for EPA and administered by the QCP communities accomplished that task, they were viable undertakings. However, viability should also be measured in terms of costs to the community, scope and extent of data generated and, the usefulness of that data once retrieved.

Under the QCP experiment, the three project communities had several distinct advantages in the application and analyses of the surveys. First, they had the advantage of a substantial number of people from the Federal Regional and Headquarters Offices as well as contractor support from Wyle Research Laboratories in the design, development, planning, administration and analyses of the acoustical and attitudinal surveys. This would not appear in any cost evaluation of the surveys and would not reflect the true picture with respect to the actual costs of the surveys. Since each of the surveys averaged almost between $20,000 and $30,000, the survey costs do appear high. Second, each of the QCP project communities had the advantage of Federal funding through the various contract(ors) involved with the program experiment. Thus, the actual costs for each community were negligible in terms of city expenditures. We are not unmindful of the need for a great deal of "hands on" assistance from the Federal EPA and from its other contractors in the administration of the QCP projects. Since this program was experimental in the first place, there was no other rational approach to the projects other than direct involvement and heavy technical assistance. We also recognize that since the manual guided surveys were part of a larger program operation dealing with the National Environmental Noise Assessment operated by the Headquarters Noise Office, a great deal of attention needed to be paid to the subject QCP communities during the developmental and implementation stages of their programs. One could draw the inference that the costs associated with the Federally sponsored QCP projects are not reflective of the costs to other communities due to the fact that those communities had more to do than just the surveys. They, in fact, laid the foundation for other communities to continue with in the use of the manual guided surveys -- at much less cost.

All this is not to say that all was favorable with the instruments themselves and their application and analyses. There were numerous delays caused by weather, availability of personnel and a dependency on the computer.

The second standard against which the manual guided surveys can be measured is their utility to the community. If the sole purpose of the surveys is to identify perceived and actual noise problems and their nature and scope, then the surveys are far too extravagant for the average community. Clearly, a streamlined approach to the surveys based on the Simplified Version of the Manuals is in order and will accomplish the job with much less of an investment of time and financing. Because of the excessive nature of the surveys (due in large part to the National Assessment) there was too much data to be gathered and interpreted. This caused delays in the implementation of the projects because of a lack of skill and familiarity on the part of the project staffs with the "newness" of the surveys and computer based implementation/analyses. The reliance on the computer based surveys caused an undue reliance on those people who developed the programs for the analysis. If other communities are to benefit from these projects, the computerization of the strategy formulated on the basis of the surveys/analyses should be left to a "common sense" approach on the part of municipal officials and not at the mercy of a computer.

Another issue raised was the skill level and ability of local officials to administer the surveys effectively. The suggestion has been made that most locales have sufficient expertise to perform the functions none of which are "unusual." We tend to agree with the assessment of Jack Faucett Associates in that respect. This adds to the viability measurement.

Finally, the importance of the surveys is to provide a basis in scientific fact on the condition of a community with respect to noise so that any actions taken by the community to abate and control excessive noise is based on a solid foundation. In this final measurement, the manual guided surveys certainly accomplish this goal, thus giving them vitality as well as viability.

RESEARCH QUESTION #2: WHAT IS THE RELATIONSHIP BETWEEN THE ACTUAL NOISE LEVELS AND THEIR PERCEPTION IN A SPECIFIC TYPE OF ENVIRONMENT?

The relationship is tenuous. Throughout the three QCP projects, the idea was formulated that there was a direct relationship between actual noise sources/levels and those sources/levels commonly perceived and articulated by the attitudinal surveys. What, in fact, happened was that there was some overlap of opinion and fact, between perception and reality, and that those noise sources which appeared in both the attitudinal and acoustical surveys as common entrants were irregular and, on the whole, obvious.

There are, however, characterizations of noise sources that provide an expanded meaning or signature of the source. For example, the noise from the motorcycle produces a certain imagery in terms of other human emotions such as fear. Associated with other characteristics or stereotypes of the people who own and operate motorcycles, the noise source can be perceived to be louder than it is in reality. This type of association and characterization is often the reason for disagreement between perceived noise source levels and actual levels based on physical measurement.

In the urban environment, such as in the three QCP communities, the incidence of precise relationship between the actual noise levels and their perception is not an insignificant factor in a community decision to undertake a noise program. The more important factor is that there are actual physical measurements that adequately demonstrate a noise problem in one or more parts of the community from one or more sources either mobile or stationary. Concurrently, there is an importance attached to the noise sources which appear prominent in the attitudinal survey due to the willingness of individuals surveyed to point out those sources and presumedly support remedial actions by the community. A cautionary note, however, is that there cannot be an assumed willingness on the part of any community to do anything about noise levels unless it is underscored that it is in the best interests of the health and welfare of the community to do so. Therefore, there is no need to expend considerable amounts of time on the question of the relationship between real and perceived noise levels.

On the subject of predictability model for community noise, while this may have been a worthwhile endeavor if the Office of Noise Abatement and Control were to retained in EPA, events have precluded this alternative activity and, in our opinion, the lack of a National Assessment will not harm the abilities of communities to ascertain the nature and extent of their noise problems without the added incumberance of drawing statistical relationships between perceptions and actualities. Perhaps the best use of the attitudinal survey data which shows a discrepancy in relationship to the acoustical survey, is to highlight those noise sources which have the best chance of receiving political attention through the complaint process; while the physical survey can best show the actual sources/levels that need attention. Thus, the attitudinal survey provides an opportunity for a community to engage in the physical measurement and a climate conducive to developing a noise control capability just as the acoustical survey opens the door further to controlling precise noise sources.

RESEARCH QUESTION #3: TO WHAT EXTENT DO COORDINATED ACOUSTICAL AND ATTITUDINAL SURVEYS OF A COMMUNITY PRODUCE COMPLEMENTARY INFORMATION?

Briefly, acoustical and attitudinal surveys produce complementary information to the extent that spatial and temporal variables can be accommodated and/or accounted for in the survey approach, methodology and analyses. Coupled with those considerations is the need to accommodate other noise characteristics in the attitudinal and complaint (if any) data. Certain sources of noise carry larger impact with them over and above their real noise levels including those which create or evoke emotional responses due to their traditional stereotypes such as the stereotype associated with the motorcycle. Therefore, attitudinal survey data will reflect stereotypical responses to certain noise sources while the acoustical data should reflect a more valid measurement.

To arrive at a clear identification of the noise problems within a community, both the acoustical and attitudinal surveys must be taken. These surveys produce complementary information in another sense as well. If, for example, a high percentage of individuals indicate on the attitudinal survey response that they are annoyed at a specific noise source -- no matter what it is -- then, that source is a definite noise problem -- despite the fact that the acoustical data reveals the specific source to be inconsequential. The community noise strategy developed on the basis of the survey must, of necessity, address the specific source. Cross referencing of the acoustical and attitudinal data also produces complementary information in a number of different categories including geographic and demographic considerations, thereby allowing for analyses and conclusion that attitudes and acoustical measurements present a fair and accurate identification of a community's noise problem(s).

In all three Quiet Community Program Experiment Cities, the acoustical survey was weighted more heavily than either complaint/response data or attitudinal data in the formulation of the respective noise abatement strategies and/or ordinances. This underscores the value of the acoustical survey as a producer of defensible information and, therefore, municipal policy and law. As illustration, the attitudinal survey in Kansas City coincided almost perfectly with the acoustical survey in demonstrating that transportation noise, especially from vehicular traffic, was the primary noise problem in the jurisdiction. However, in Spokane, Washington, under the heading of 'domestic noise', the acoustical survey showed 'people noise' most prevalent while the attitudinal survey labeled 'barking dogs' as the largest noise problem. The complaint survey in Spokane confirmed the barking dog as the biggest problem. Even more striking was the disparity between the attitudinal survey and acoustical survey in Spokane relative to surface transportation noise. The acoustical data showed automobiles and trucks to be responsible for almost 96 percent of the noise; the complaint data revealed that off-road vehicles and motorcylces accounted for 90 percent of noise complaints -- while the attitudinal survey demonstrated that there was a relatively even distribution among all sources identified.

It is our opinion that the surveys produce highly complementary information, the use of which is absolutely vital to the development of a comprehensive noise strategy and subsequent legal ratification and codification of a viable noise abatement and control program. However, the effort would be wasted if the community did not undertake to educate and inform the public about noise, the causes and effects, and the things that individuals can do to prevent overexposure to excessive noise as an integral part of the community noise control effort.

OVERVIEW OF QUESTIONS 4-8

Examination of Correlation Between Attitudinal Survey Responses and Noise Measures from Acoustical Survey

This section of the report deals with questions 4-8 posed by EPA; i.e., performing attitudinal and acoustical measures obtained in the study. Kansas City was divided into nine geographic areas designed to be demographically homogeneous, and fourteen noise zones, designed to be acoustically homogeneous.

Correlative analyses were conducted first by geographic area, then by noise zone. When examining geographic areas, only weak relationships were found between the physical sound level measurements taken in the acoustical survey and the responses tabulated in the attitudinal survey; i.e., there was little evidence that higher sound levels were associated with higher percentages of respondents indicating strong annoyance by, or perceptions of, noise. Indeed, a similar pattern of weak association was found between the attitudinal responses and demographic variables. However, when data were analyzed by noise zone, strong correlations were observed between the physical measurements and the attitudinal responses. This pattern appears to have emerged; i.e., become discernible, because of the greater acoustically homogeneous nature of the noise zones. Thus, we can conclude, based on the evidence available from Kansas City, that there is a correlation between physical sound levels and attitudinal responses.

Notwithstanding the fact that the noise zones defined in Kansas City are more acoustically homogeneous than the geographic areas, an analysis of the standard deviations of the average dB levels obtained in the acoustical survey indicate that the objectives for acoustical homogeneity were not achieved. There was a much greater degree of variation in the L_{dn} measurements caused by day of the week, spatial separation and unidentified errors, both in Allentown and Kansas City, than desired under the research design.

Methodology for Correlation Analysis

The design for examining the correlations between attitudinal responses and acoustical measurements called for the following sequence of steps:

1. Conduct attitudinal survey
2. Conduct acoustical survey, incorporating certain response data from attitudinal survey in making adjustments
3. Incorporate acoustical measurements in creating dB level variable for each noise zone and geographical area, assigning these values to each respondent in the attitudinal survey

4. Run the regressions with dB levels alternatively on a dependent variable, and on an independent (explanatory) variable. The correlations between each pair of variables would be output as a byproduct of these regressions.

Due to the budget cutbacks in the EPA noise program, and subsequent exodus of key personnel, only steps 1 and 2 were completed for Kansas City.

In order to run the correlation analyses required to properly respond to questions 4-8, the Center for Public Management established a plan to complete steps 3 and 4. Unfortunately, the data base had been archived for several months. Knowledgeable staff personnel were gone, and there was a gap in the documentation and information available to de-archive the data files in a timely fashion. Thus, it was necessary to carry out the correlation studies using the data that were available from printouts prepared for steps 1 and 2 above.

The correlation analysis required to answer question 5 was accomplished using aggregate measures for each noise zone and geographic area. Summary data were available, showing the average dB levels in each of nine geographic areas, and in each of twelve noise source zones.[1] Corresponding to these, attitudinal response summaries were also available. Entering these summaries as input data, correlations were run on a microcomputer separately across the nine geographic areas and twelve noise source zones. These results are reported in the analysis.

To carry out the analysis required by question 6; i.e., to examine the relationship between the response data and demographic variables in the city, there was much relevant data available from steps 1 and 2. A wealth of data was available from cross-tabulations of attitudinal responses from about 500 respondents, by the nine geographic areas. Since the nine geographic areas were defined to represent homogeneous demographic groups, these cross-tabs were directly useful in examining the relationship between the attitudes and the demographic composition of the city. In addition, since the acoustical survey data were also coded by these nine geographic areas, the correspondence between the physical dB levels and the attitudes, controlling for demographic factors, could be examined.

The answers to questions 4, 7 and 8 were developed based on an examination of background documentation for Allentown, Spokane and Kansas City, the experience gained in the correlation analyses required for questions 5 and 6, and interviews conducted with participants in the Kansas City and Allentown surveys.

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[1] Actually, there were 14 noise source zones tabulated, but only twelve for which both attitudinal and acoustical survey measures were available.

QUESTION #4: HOW CAN EFFECTIVE INTEGRATION OF ACOUSTICAL, AND ATTITUDINAL SURVEYS BE ACHIEVED?

The major thrust of the attitudinal and acoustical surveys is to generate data that can be used in preparing an ordinance to control noise. It is necessary to relate the physical measurements obtained in the acoustical survey to the attitudinal response data to prepare an effective analysis.

The design calls for the attitudinal survey to be conducted first, followed by the acoustical survey. After the physical noise levels are measured, these should then be combined with the attitudinal survey data, using the Statistical Package for the Social Sciences (SPSS) Recode Z program to create the dB level variable. SPSS is the standard statistical software package used in preparing the cross tabulations and regression analyses included in the printouts. The SPSS Recode program is that component of SPSS that is used to feed the results of the acoustical survey back into the attitudinal survey data analysis so that physical noise measurement data can be correlated to the attitudinal data. Once the dB level variable is created, the regression analyses can be run alternatively with dB level as a dependent variable and an explanatory variable. In this manner, the city can ascertain the physical noise levels that are acceptable as limits for purposes of drawing up a noise ordinance. This analysis was not accomplished in Kansas City due to losses of personnel after project budget cuts. In Kansas City, the physical noise levels for each noise source in each zone were developed. What was not developed was a city-wide composite measure for each noise source. Such a city-wide measure is exactly what is needed to determine the noise source dB levels limits for inclusion in the ordinance.

QUESTION #5: TO WHAT EXTENT ARE NOISE LEVEL RESPONSE DATA CORRELATIVE WITH NOISE SOURCE DATA?

In order to address this question, several hypotheses were structured. The hypotheses were developed to test the assumption that the noise-level response data (attitudinal survey responses) were correlated to the noise source data.

1. The percent reporting their areas as being noisy or very noisy is correlated to the physical noise levels measured in the acoustical survey.

2. The percent reporting unacceptable noise levels is positively correlated to the physical noise levels.

3. The percent persons responding that their areas had moderately to extremely severe noise problems is correlated to the physical noise levels.

4. The percent persons reporting considerable to tremendous annoyance by noise is correlated to the physical noise levels.

5. The percent persons evaluating noise control in their areas as poor is correlated to the physical noise levels.

Table 1 shows a tabulation of the nine geographic zones of the city. The noise levels, as measured by L_{dn} and L_{eq} levels in the acoustical survey, are presented in columns 3 and 4. The remaining colums present corresponding data from the attitudinal survey responses.

Table 2 was constructed to provide information for testing these four hypotheses. The table shows the simple correlations (strength of association) between certain responses to the attitudinal survey and the physical noise levels. As may be seen from the correlation between dB level and itself, a perfect correlation is 1.00. No correlation is shown by a level of .00. Negative values show that the variables grow in opposite directions; e.g., as one variable increases, the other tends to decrease. Correlations of less than .40 could not be considered substantial or consequential in indicating a relationship between two variables.

It may be seen from Table 2 that only in the percentage of persons reporting unacceptable or very unacceptable noise in their areas was there a substantial correlation between any attitudinal response variable and the dB levels measured in the acoustical survey. Thus, only hypothesis 2 received substantial support from the data.

Table 1

Seven Day Aggregate Noise Level Statistics, Day and Night
By Geographical Zone

Zone	Type	Sound Levels In Decibels L_{dn}*	Sound Levels In Decibels L_{eq}**	Percent Noisy or Very Noisy	Percent Unacceptable or Very Unacceptable	Percent Moderately to Extremely Severe Noise Problem	Percent Considerably to Tremendously Annoyed by Noise	Percent Eval. Area Noise Con. as Poor or Very Poor
1	Central Business	68.2	67.1	66.7	27.8	37.5	12.5	14.3
2	Industrial	68.6	65.5	59.6	16.7	0.0	0.0	0.0
3	Kansas City North	75.3	70.5	48.4	47.4	29.9	17.6	19.4
4	Center City	78.1	71.7	48.0	26.5	29.4	10.8	16.2
5	West City	66.2	63.8	39.3	18.1	36.3	15.5	19.1
6	South City	70.0	68.9	31.8	12.1	33.3	11.0	17.4
7	East Blue River	70.8	67.0	57.2	44.6	36.6	12.2	7.5
8	West Blue River	63.0	62.5	30.0	13.3	23.8	14.3	9.8
9	Northeast	72.0	69.8	52.1	29.2	39.2	23.5	25.5

*L_{dn} - A weighted average sound level during a 24 hour period (10 decibel weightings applied to night-time sound level).

**L_{eq} - Energy mean noise level taken over a 24 hour period.

Table 2

Correlations of Physical Noise Levels
With Attitudinal Responses
By Geographic Zone

Variable	Decibel Levels L_{dn}	Percent Noisy	Percent Unaccept. Noise	Percent Severe Problems	Percent Annoyed	Percent Eval. Noise Control as Poor
Decibel Level (L_{dn})	1.00	.28	.57	.15	.12	.34
Percent Noisy or Very Noisy	.28	1.00	.50	-.09	-.22	-.25
Percent Unacceptable or Very Unaccept. Noise	.57	.50	1.00	.34	.35	.17
Percent Moderate to Extremely Severe Noise Problem	.15	-.09	.34	1.00	.79	.76
Percent Considerably to Tremendously Annoyed by Noise	.12	-.22	.35	.79	1.00	.86
Percent Evaluating Noise Control as Poor or Very Poor	.34	-.25	.17	.76	.86	1.00

One might question the use of simple correlations in testing these hypotheses. It could be argued that unless one controlled other relevant variables, it was not possible to evaluate the effect of one particular variable on another. Stated another way, to investigate the correlations between percent annoyance and dB levels, it was necessary to hold constant (statistically) the variation in other demographic and attitudinal variables. Hence, it appeared desirable to investigate the multiple regression relationships among the variables, particularly across the approximately 500 respondents to the attitudinal survey. The design called for performing this analysis with dB level as the dependent variable in a step-wise multiple linear regression. The entire range of attitudinal and demographic variables was to be used as possible independent variables to "explain" variation in the dB level. In other words, an attempt would be made to structure a model that would estimate the dB level on the basis of a combination of independent variables drawn from the survey results. Actually, the runs were made during the processing of the attitudinal survey data in Kansas City, because those regressions were built into the computer program. Unfortunately, for reasons stated earlier, the dB level variable was meaningless because steps 3 and 4 were never carried out in Kansas City.

Since only aggregate data were available with which to run regressions, several simple regression models were attempted using the nine geographic areas as units of analysis.

The percentage of persons considerably to tremendously annoyed could be estimated using the following regression model:

$$\begin{aligned}\text{Percent annoyed} = {} & .77 \times \text{Percent evaluating noise control as poor} \\ & - .26 \times \text{dB level} \\ & + 20.5\end{aligned}$$

The R^2 for this model was .77, indicating that the model explained about 77 percent of the variation in percent annoyed. However, the most significant factor in explaining the degree of annoyance was the evaluation factor from the attitudinal survey, not the physical dB level from the acoustical survey.

An attempt was made to construct single regression models to predict attitudinal responses from the average physical dB levels of the geographic areas. In no case was a satisfactory model possible.

Another set of regression analyses was constructed using the noise source zones as the units of analysis. Table 3 presents data organized by noise zone in Kansas City. These are geographic zones of the city, defined to be acoustically homogeneous. The predominant acoustical characteristic of each zone is identified in the column headed "type" in Table 3. The table relates physical sound level measures (L_{dn} and L_{eq}) obtained in the acoustical survey to two noise response measures obtained in the attitudinal survey.

Table 3

Noise Zone

Noise Zone Category	Type	Percent of City Population Within Zone	7 Day Aggreg. Sound Levels L_{dn}	7 Day Aggreg. Sound Levels L_{eq}	Percent Noisy or Very Noisy	Percent Unacceptable or Very Unacceptable
	Aircraft A	.01	75.0	NA		
	Aircraft B	.01	65.0	NA		
	Railroad	7.30	61.0	NA		
CI	Commercial/Indust.	1.80	69.5	68.4	52.7	25.0
H	Highways	3.90	81.7	76.0	88.5	69.3
	Residential					
RL	Low to Med. Density	43.80	63.5	61.7	20.8	11.2
RH	High to Very High Dens.	39.70	67.8	65.1	36.9	19.6
	Roadway					
ML	Low Volume	1.31	72.7	68.9	50.0	43.8
MH	High Volume	1.10	74.7	70.9	72.0	56.0
A	Major Roadway	.20	64.6	60.6	46.0	20.6
B	Major Roadway		64.3	62.3	33.0	15.9
	Stationary	.60	--	--		
SA	Railroad Yard, Bottoms	--	69.8	66.2	65.2	8.7
SB	Railroad Yard, West	--	68.3	68.2	16.7	16.7
SC	Sport Complex	--	68.2	63.2	64.3	64.3
SD	Raceway	--	71.9	71.6	21.4	9.5

A regression analysis was conducted across the twelve noise zones for which both acoustical measures and attitudinal response data were available. As may be seen from Table 4, the correlations between physical sound level measures and attitudinal responses across noise zones was much higher than across geographic areas. The data strongly indicate that physical noise levels are highly correlative to attitudinal response data when the areas under analysis are acoustically homogeneous.

Several regression models were developed that could be used to predict attitudinal data on the basis of dB levels using noise zones as the units of analyses. The first model predicted percentage persons reporting unacceptable or very unacceptable quite well using noise levels as the only explanatory variable. The model was

$$\text{Percent reporting unacceptable or very unacceptable noise} = 3.28\ L_{dn} - 199.08$$

This model had an R^2 of .8. The t statistic (measure of the statistical significance) of 5.5 for the L_{dn} variable was statistically significant.

Table 4

Correlation Matrix
Noise Zone Data

Variable	L_{dn}	Percent Noisy Or Very Noisy	Percent Reporting Unacceptable or Very Unacceptable Noise
L_{dn}	1.00	.91	.90
Percent Noisy or Very Noisy	.91	1.00	.76
Percent Unacceptable or Very Unacceptable Noise	.90	.76	1.00

A second model predicting percent reporting their areas as being noisy or very noisy on the basis of average decibel level in the noise zone also did well. Here the model was:

Percent reporting noisy or very noisy areas = $3.28 \times L_{dn} - 199$

The R^2 for this model was .81 and the positive statistic for the L_{dn} of 5.52 was statistically significant.

QUESTION #6: HOW DO THE RESPONSE DATA RELATE TO THE DEMOGRAPHIC VARIABLES IN A CITY?

Kansas City was divided into nine (9) relatively homogeneous geographic areas. This classification was based on similarity as to types and age of housing, educational background of residents, age, income and ethnic background.

If the responses with respect to noise factors were significantly related to demographic variables, one would expect the following hypotheses (theories) to be supported by the data:

1. The responses to Question 8 regarding quietness of area of residence are significantly related to the nine residential areas.

2. The responses to Question 5 on severity of the noise problem are significantly related to the nine residential areas of the city.

3. The responses to Question 6 on evaluation of noise control are significantly related to the nine residential areas.

4. The responses to Question 12 on whether noise affects physical health are significantly related to residential area.

5. The degree of annoyance by noise responses are significantly related to the nine residential areas.

6. The time periods of noise annoyance responses to Question 11 are significantly related to the nine residential areas.

In order to test these hypotheses, we will look at cross-tabulations of the two variables represented in each hypothesis. First, we will examine whether the relationship appears to be statistically significant. Here, we will set the .05 level as our threshhold for testing significance. This may be interpreted as follows. We cross-tabulate one variable against another and observe the distribution, computing a raw chi-square statistic. We are testing to see if the two variables are statistically independent. If the chi-square statistic is significant at the .05 level, we are saying that apart from 5 chances in 100, a value of chi-square as high as that observed could not have occurred if the two variables were independent. Hence, they are deemed to be associated.

Table 5

Quietness of Area, by Residential Area
Kansas City, Missouri

Question 8 Quietness or Noisiness	Residential Area									Total
	1	2	3	4	5	6	7	8	9	
Very Noisy	1	0	3	3	3	1	0	0	6	17
Noisy	2	0	15	25	33	16	7	6	15	118
Quiet	5	1	34	74	55	45	27	28	21	290
Very Quiet	0	0	16	18	12	11	7	9	9	82
TOTAL	8	1	68	120	103	73	41	42	51	507

Raw chi-square = 36.25 with 24 degrees of freedom; significance = .05

Even if the relationship between the two variables is statistically significant, i.e., the variables are statistically associated with each other, nothing has been said about the strength of the association. A second test, involving the computation of Cramers V statistic, was performed to examine the strength of association between two variables.[1] Cramer's V is calculated from the chi-square statistic x^2, as follows:

First, we calculate Phi, as

$$\Phi = \left(\frac{x^2}{n} \right)^{\frac{1}{2}}$$

Second, we calculate Cramer's V, as

$$V = \left(\frac{\Phi^2}{\min(r-1, c-1)} \right)^{\frac{1}{2}}$$

The nine residential areas were cross-tabulated against the sixteen noise zones. The chi-square of 1137.97 with 88 degrees of freedom is significant at the .00 level. Thus, we see that the nine residential areas are significantly related to the noise zones (dB levels).

To test the first hypothesis we look at the data of Table 5. The data of Table 5 indicate that the responses to Question 8 on the quietness or noisiness of the area are significantly related to the residential area; i.e., the relationship is siginficant at the .05 level.

To further test the strength of the relationship, we compute Cramer's V

$$V = \left(\frac{.07}{3} \right)^{\frac{1}{2}} = .15$$

Thus, although the relationship is significant, it is not very strong. Hence, we conclude that hyposhesis 1 is weakly supported by the data.

The second hypothesis concerned the relationship between the nine geographic areas and the responses to Question 5 on severity of the noise problem. The relevant data are shown in Table 6.

The data of Table 6 indicate that the responses to Question 5 on severity of the noise problem are not significantly related to the residential area.

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[1] For a discussion of Cramer's V statistic, see Statistical Package for the Social Sciences (SPSS), second edition, McGraw Hill, New York, New York, 1975, pages 224-225.

Table 6

Relation Between Responses on Severity of Noise Problems and Nine Residential Areas Kansas City, Missouri

Severity of Noise Problems	Residential Area									Total
	1	2	3	4	5	6	7	8	9	
Not a Problem	4	1	44	76	56	44	23	29	27	304
Not Very Severe	1	0	3	8	9	4	3	3	4	35
Moderately Severe	1	0	13	23	24	20	11	7	10	109
Quite Severe	1	0	4	8	10	5	2	2	7	39
Extremely Severe	1	0	3	4	3	0	2	1	3	17
TOTAL	8	1	67	119	102	73	41	42	51	504

Chi-square = 18.54 with 32 degrees of freedom; significance = .97

The third hypothesis concerned the relationship between the nine geographic areas and the responses to Question 6 on evaluation of noise control in the area. The relevant data are shown in Table 7.

The data of Table 7 indicate that respondent's evaluation of noise control in their areas are not significantly related to their area of residence.

Hypothesis 4 concerning responses to Question 12 on whether noise effects physical health was examined using the data of Table 8.

The data of Table 8 fail to support hypothesis 4; i.e., the two variables are not significantly related to each other.

Hypothesis 5 regarding the degree of annoyance by noise was examined using the data of Table 9.

The data of Table 9 show that the degree of annoyance by noise responses to Question 9 are significantly related to the nine areas of residence; i.e., the relationship is significant at the .02 level.

Investigating the strength of the relationship, we compute Cramer's V as follows:

$$V = \left(\frac{.137}{6}\right)^{\frac{1}{2}} = .15$$

Thus, although the relationship is significant, its strength is quite weak and hypothesis 5 is only weakly supported.

A review of various cross tabulations of responses to specific sources of noise failed to show any significant relationships to the nine geographic areas of the city.

Table 7

Relation between Responses on Evaluation of Area
and Nine Geographic Areas of Residence
Kansas City, Missouri

Evaluation of Noise Control	Residential Area									Total
	1	2	3	4	5	6	7	8	9	
Very poor	1	0	2	3	4	2	2	1	2	17
Poor	0	0	11	16	13	10	1	3	11	65
Fair	1	0	9	46	33	13	15	15	20	152
Good	4	1	37	46	33	35	17	18	13	204
Very good	1	0	8	6	6	9	5	4	5	44
Total	7	1	67	117	89	69	40	41	51	482

Raw Chi Square = 43.0 with 32 degrees of freedom; significance = .09.

Table 8

Relation between Responses on Noise Effects on Health and Nine Residential Areas Kansas City, Missouri

Noise Affects Health	Residential Areas									Total
	1	2	3	4	5	6	7	8	9	
No	7	1	40	85	64	39	24	23	25	308
Maybe	0	0	3	7	4	5	3	2	3	27
Yes	1	0	25	24	33	29	14	17	23	166
Total	8	1	68	116	101	73	41	42	51	501

Raw Chi Square = 18.9 with 16 degreas of freedom; significance = .27.

Table 9

Relation between Degree of Annoyance
by Noise and Residential Area
Kansas City, Missouri

Degree of Annoyance	Residential Area									Total
	1	2	3	4	5	6	7	8	9	
Tremendously annoyed	0	0	1	0	0	1	3	2	0	7
Highly annoyed	0	0	2	9	3	2	1	1	7	25
Considerably annoyed	1	0	9	4	13	5	1	3	5	41
Mediumly annoyed	0	0	12	18	16	12	5	1	10	74
Partially annoyed	0	0	9	15	19	9	5	4	4	65
A little annoyed	3	1	8	29	19	17	11	14	14	116
Not at all annoyed	4	0	27	45	33	27	15	17	11	179
Total	8	1	68	120	103	73	41	42	51	507

Chi square = 69.51 with 48 degrees of freedom; significance = .02.

QUESTION #7: IS THE PRECISION OF THE SPATIAL AND TEMPORAL SAMPLING PLANS THE SAME IN CITIES OF VARYING SIZE AND LAND USE CONFIGURATIONS?

The precision of both the spatial and temporal sampling plans will vary in cities of varying size and land use configurations. The number of sites needed varies with the geographic area to be covered; hence, the spatial sampling plan varies accordingly. The temporal sampling plan also varies because the data are collected by people visiting the sites to make readings. The logistics of data collection are thus greatly different in cities of varying size and land use.

The original prototype sampling plan was developed in Allentown, Pennsylvania, which covered 17 square miles. When this sample design was applied in Kansas City, which covers 316 square miles, it was found to be highly inadequate. Kansas City required about one-third more sites to cover the larger area. In order to collect data from this many additional sites, the Kansas City project team requested about nine times the resources to provide the people to visit the sites to make the readings. In fact, Kansas City generated so much data, the computer system could not handle it all, resulting in cutbacks in data processing.

Allentown's sampling approach was to divide the city into clusters of blocks and block groups, and to select the cluster containing every 419th household to obtain a one percent random sample of clusters. Then, one out of every seven households in each sampled cluster was selected for interviews. This apparently resulted in a representative sample of the city's demographics; i.e., the sample's demographics were closely matched to the general population with respect to age, sex, ethnicity, education, size of household and other demographic characteristics. However, according to Allentown's assessment report, the precision of the acoustical survey results was less than expected.[1]

Kansas City adopted a two-fold stratification scheme. First, they divided the city into a hierarchy of sixteen noise zones, ranging from the most extreme aircraft noise to the least extreme low density residential zone. Next, they divided the city into nine geographic areas, defined to be demographically homogeneous. They attempted to select a random sample that would be representative of the various combinations of noise zones and demographic types. Hence, they required a larger sample than originally allocated by EPA based on the Allentown experience, and selected 250 sites. They would have liked to select more sites, but were constrained by available resources.

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[1]See Volume 1: Summary of the Methodology, Allentown Assessment Report, EPA.

The standard deviation is an indicator of the comparative precision of the sampling plans adopted in each city. Table 10 compares the spatial standard deviations obtained in Allentown and Kansas City. With the larger sample of sites used in Kansas City, their standard deviations were lower than those of Allentown in major roadways and residential areas. The spatial standard deviations obtained in the acoustical survey could be reduced by taking data at more locations.

Prior EPA experience has shown that there is a relationship between noise levels and population density, degree of urbanization, and proximity to noise sources such as traffic and aircraft. A major objective of the study design evolving from such experience has been to develop reliable data on the physical noise levels of the various noise sources, city-wide. This has led to the definition of acoustically homogeneous noise zones, and the conduct of the acoustical survey in the test cities. Another major objective has been to discover patterns of relationships between attitudes of residents and their proximity to various noise sources.

In order to develop a set of data that would support the desire to represent both the demographic mix of the city's population, and their proximity to noise sources, a two-fold stratification approach similar to that adopted by Kansas City is necessary. Indeed, the sample design should provide for dividing the city into sub-populations, representing the relevant combinations of demographic type and noise zone. Each sub-population should then be randomly sampled.

For example, Kansas City divided the city into nine geographic areas designed to be demographically homogeneous. These, we call "geo-demographic areas." Kansas City also divided the city into sixteen acoustically homogeneous noise zones. That makes a possible 144 combinations (16 x 9); i.e., sub-populations to be sampled. If each city block, block group or other suitable census unit is assigned its applicable geodemographic area and noise zone identification code, all the city's households can be assigned to one of the relevant sub-populations. (The aircraft noise zones were not deemed relevant for the attitudinal survey sample.) Then, following the Wyle design, a random sample of households can be drawn from each sub-population. The sites for the acoustical survey can also be selected according to the Wyle design within each sub-population.

By selecting a random sample within each sub-population (noise zone-geographic area combination), the design should enable more precise measurement of noise levels for each source, and correlations of physical noise measurements and attitudinal responses.

Table 10

Comparison of Spatial Standard Deviations by Selected Noise Zones

Noise Zone	Allentown	Kansas City
Minor roadway	3.6	5.5 - 8.0*
Highway	5.1	7.1
Major roadway B	7.2	5.2
Major roadway A	7.4	4.2
Residential	8.2	5.9 - 7.1**

*Kansas City obtained 24 hour standard deviation of 5.5 for high volume and 8.0 for low volume minor roadways, respectively.

**Kansas City obtained 24 hour spatial standard deviations of 5.9 for low density and 7.1 for high density residential zones respectively.

QUESTION #8: ARE NOISE ZONES WHICH ARE CONSTRUCTED ACCORDING TO THE SPATIAL SAMPLING TECHNIQUE ACOUSTICALLY HOMOGENEOUS AS MEASURED BY THE STANDARD DEVIATION?

The stated objectives of the Class I and Class II acoustical surveys are, at the 95 percent level of confidence, ±5dB and ±2dB, respectively in the L_{dn} of highway, major roadway, minor roadway and residential zones with a 4-6dB spatial standard deviation.[1] This is equivalent to stating that the standard deviation of the (normally distributed) measurement errors would be ±2.5dB and ±1.0dB respectively.

Table 11 shows the distribution of the standard deviations of acoustical measurements in Kansas City for various temporal and spatial averages. From the last column of Table 11, we see that in Kansas City the spatial average levels of L_{dn} showed standard deviations varying from 4.19 for major roadways to 11.48 for the railroad yard noise zone. There were differences reported for week day and week and readings. Considering the distribution of standard deviations for the 7 day aggregate, week day and weekend measurements, in no case were the desired objectives for acoustical homogeniety achieved.

An examination of the data shows that the railroad year (SB), raceway (SD), highways (H) and minor roadways with low volume (MC) were the most acoustically heterogeneous noise zones. Certain zones were more homogeneous on weekends (SB). The various types of measurements appeared to be highly correlated with each other. The noise zones were certainly more acoustically homogeneous than the geographic areas which were designed to be demographically homogeneous. This may be seen by comparing the data which show correlations between dB levels and attitudinal responses across geographic areas (Table 2) and across noise zones (Table 4). The correlations shown in Table 4 are very high compared to those shown in Table 2, indicating (not surprisingly) a much greater degree of acoustical homogeneity in the noise zones.

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[1] Wyle Research Report WR 77-17.

Table 11

Analysis of Acoustical Homogeneity of Noise Zone Kansas City, Missouri

Noise Zone Code	% of City Pop.	Noise Zone Type	Predom. Noise Source	Average Decibel levels 7 Day Aggregate		Standard Deviations (SD's)			
				L_{dn}	L_{eq}	7 Day Aggregate	Week Days	Weekend	24 Hour Spatial
SA	.60	Railroad yard	Railroad	69.8	66.2	7.6	8.2	6.0	5.75
SB		Railroad yard	Auto, Rail	68.3	68.2	11.5	11.2	3.4	11.48
SC		Sport complex	Mixed	68.2	63.2	6.7	7.1	5.5	4.84
SD		Raceway	Mixed	71.9	71.6	12.7	13.0	11.4	7.68
CI	1.80	Commercial/ Industrial	Auto	69.5	68.4	9.9	10.2	8.9	7.46
A	.20	Major roadway	Auto	64.6	60.6	7.1	7.2	6.6	4.19
B	.60	Major roadway	Auto	64.3	62.3	7.4	7.9	6.1	5.16
H	3.90	Highway	Auto	81.7	76.0	10.9	11.2	9.9	7.13
MH	1.10	Minor roadway, high volume	Auto	74.7	70.9	9.4	9.9	7.8	5.47
ML	1.31	Minor roadway, low volume	Auto	72.7	68.8	11.5	11.7	10.9	8.00
RH	39.70	Residential, high density	Auto	67.8	65.1	9.3	9.4	9.0	7.14
RL	43.80	Residential, low density	Auto	63.5	61.7	9.1	9.4	8.3	5.91

RESEARCH QUESTION #9: CAN PUBLIC ATTITUDES TOWARDS NOISE BE MEANINGFULLY COMPARED WITH ATTITUDES TOWARDS OTHER FORMS OF POLLUTION?

Quite simply, yes, public attitudes towards noise can be meaningfully compared with other forms of environmental pollution. However, when comparing noise to other forms of pollution, the level of knowledge of the general public relative to each form is going to be uneven, thereby making the comparison less meaningful than it should be.

Noise, as a pollutant form, is the least understood by the general public. It is also a relative newcomer to the environmental sphere of pollution control and has been traditionally relegated to the nuisance category. Whereas, water pollution and air pollution are traced back to biblical times and have been a subject of concern that most individuals have greater levels of knowledge about than noise. Essentially, other forms of pollution and environmental hazard as well as health hazards have received the preponderance of attention, control resources and, as a result of the resource attachment, the priority among Federal, State and local governments.

Noise is the only facility-less form of pollution which has resulted in a degree of inability to focus in on the most expeditious form of treatment. By way of comparison, wastewater treatment has been targeted on the construction of sewage treatment plants and on discharge permits to accomplish the bulk of water pollution control. Noise has no treatment plant and it is the product of just about everything with moving parts. This underlying uncertainty about the noise medium contributes to a political and governmental inertia regarding its abatement and control.

To add to the lack of understanding about noise is the lack of research being undertaken about its effects. The body of knowledge that exists today leads us to believe that noise is definitely a health hazard and that it needs to be controlled -- but at what level, by who, with how much money, and at what price to the noise maker, are all questions that need to be resolved. This has been somewhat clarified by the Congress of the United States when it declared the policy of the United States to be that noise is primarily a State and local problem which means that the Federal investment in noise control shall be limited. This is not so with other pollution forms where vast sums of taxpayers dollars have been given to their abatement and control. Accompanying those expenditures are headlines, education and public information raising the level of knowledge of those forms of environmental pollution on the part of the general public.

During the implementation of the three Quiet Community Program experiments, each city performed attitudinal surveys to measure the public's opinion about noise and its principal objections to specific sources. For purposes of comparison with other forms of pollution, the surveys asked respondents to compare noise to such other forms in an indirect manner and not as a direct prioritization of pollutants. Page 2 of the survey instrument prepared for EPA use in the

QCP Program asks respondents to indicate whether or not and the extent to which the following items are problems: Traffic Congestion, Polluted Water, Noise, Crime, Run-down Areas in Need of Development, Unclean Air, Parking, Inadequate Low-Income Housing, within their communities. While this may provide insight into what an individual thinks about his or her immediate community, it provides no insight into the overall comparison of the relative degree of importance placed on the various forms of environmental pollution, hazard and degradation. In short, the attitudinal survey designed for the QCP experiment was designed to provide information as to where noise -- quiet lifestyle -- ranks among a selected group of community problems; not to be used as a comparison tool with other pollutants.

Still, the attitudinal surveys allowed for a meaningful determination of the value placed on quiet in the community -- which was their primary function and, in that light, noise was significantly more important to the public than other forms of pollution because of the frequency of occurrence and annoyance factors. Therefore, it is reasonable to assume that noise -- or the lack thereof -- is a very important issue at the local community and neighborhood level. Whereas we have achieved a high degree of cleaner air and water in the past two decades, we have yet to impact environmental noise levels which will continue to be a source of complaint and potential health hazard well into the next century.

Finally, in a time of economic constraint where the effects are being felt at all layers of government, noise abatement and control will not achieve any higher priority unless it can be shown that the general public is serious enough about it to demand state and local governmental action. Where the public has done this, noise abatement and control programs continue to be functional and protective of the health and welfare of the public. Where the public has not, noise control programs are not likely to arise. Therefore, the control of noise at the state and local levels depends almost entirely upon two factors. First is the ability of the free market to product quieter products for business, industry and home use. Second, is the required increase in the public's knowledge of noise, its causes, effects and the extent to which individuals can resolve those problems.